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CLAIMS

1.   A method of determining a location of a mobile communication device in a mobile communication network including a plurality of base stations, comprising the steps of:

5   receiving a plurality of pieces of base station signal information, the base station signal information including base station identification information, the base stations transmitting the base station signal information to the mobile communication device;

determining a base station corresponding to each of the plurality of pieces of
10   base station signal information based on the base station identification information;

generating vector information associated with the plurality of the base stations based on geographic information corresponding to the determined base station; and

generating location information of the device according to the generated vector information,

15   wherein the step of generating the vector information comprises the steps of:

determining a predetermined vector proceeding order associated with the plurality of the base stations according to the base station signal information; and

sequentially determining a vector with respect to the plurality of the base stations according to the determined vector proceeding order, with the base station in
20   which the device is currently communicating with as a starting point.

2.   The method of claim 1, wherein the mobile communication network is based on a synchronous network and the base station signal information comprises propagation delay time information, and, in the step of determining the predetermined vector
25   proceeding order, the vector proceeding order is determined by the order of the small propagation delay time.

3.   The method of claim 1, wherein the mobile communication network is based on an asynchronous network and the base station signal information comprises received
30   signal strength information, and, in the step of determining the predetermined vector proceeding order, the vector proceeding order is determined by the order of the strength of the measured received signal.

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4.   The method of claim 1, wherein the base station signal information comprises received signal strength information, and, in the step of determining the predetermined vector proceeding order, a base station associated with the base station signal information whose measured received signal strength is less than a predetermined value is excluded from the vector proceeding order.

5.   The method of claim 1, wherein the step of sequentially determining the vector with respect to the plurality of the base stations comprises the steps of:

determining a direction of the vector from a first base station that is a former to a second base station that is a latter;

computing a distance between the first base station and the second base station and determining the size of the vector by multiplying the distance by a predetermined value; and

determining the vector between the first base station and the second base station based on the direction and the size of the vector.

6.   The method of claim 5, wherein the predetermined value becomes gradually reduced according to the vector proceeding order.

7.   A method of determining a location of a mobile communication device in a mobile communication network including a plurality of base stations and repeaters, comprising the steps of:

receiving a plurality of pieces of base station signal information transmitted from the base station to the device;

determining one of a base station and a repeater corresponding to each of the base station signal information based on propagation delay time information;

generating vector information associated with the plurality of the base stations and repeaters based on geographic information corresponding to one of the determined base station and the repeater; and

generating location information of the device according to the generated vector information,

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wherein the step of generating the vector information comprises the steps of:

determining a predetermined vector proceeding order associated with the plurality of the base stations and repeaters according to the base station signal information; and

5   sequentially determining a vector with respect to the plurality of the base stations and repeaters according to the determined vector proceeding order with one of the base station and repeater in which the device is currently communicating with as a starting point.

10   8.   The method of claim 7, wherein the mobile communication network is based on a synchronous network, the base station signal information comprises a propagation delay time, and, in the step of determining the predetermined vector proceeding order, the vector proceeding order is determined to be in the order of the smallest to the largest propagation delay time.

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9.   The method of claim 8, wherein the step of determining the one of the base station and repeater corresponding to each of the base station signal information comprises the steps of:

determining a first propagation delay time that is the smallest of the
20   propagation delay times;

determining a time difference between a second propagation delay time and the first propagation delay time; and

determining the base station signal information associated with the second propagation delay time to be base station signal information going by way of the
25   repeater in the case the time difference is not less than a predetermined value.

10.   The method of claim 9, wherein the step of determining the base station signal information associated with the second propagation delay time to be the base station signal information going by way of the repeater comprises the step of determining the
30   repeater located closest to the base station associated with the base station signal information received first of the plurality of the base station signal to be the repeater of which the base station signal information goes by way in the case the base station

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associated with the second propagation delay time is connected to the plurality of the repeaters.

11.   The method of claim 7, wherein the mobile communication network is based on
5   an asynchronous network and the base station signal information comprises a round trip time.

12.   The method of claim 11, wherein the step of determining the one of the base station and the repeater corresponding to the each of the base station signal information
10 comprises the step of determining the base station signal information associated with the round trip delay time to be the base station signal information going by way of the repeater in the case the round trip delay time is not less than a predetermined value.

13.   The method of claim 12, wherein the step of determining the base station signal
15 information associated with the round trip delay time to be the base station signal information going by way of the repeater comprises the step of determining the repeater connected to the base station located closest to the base station whose received signal strength is greatest, excluding the base station with which the device is currently communicating with, to be the repeater of which the base station signal information
20 going by way of the repeater associated with the round trip delay time is connected to a plurality of the repeaters.

14.   The method according to any one of claims 1 and 7, further comprising the steps of:
25   dividing an area covered by the mobile communication network into a plurality of grids, determining second base station signal information with respect to the divided grid in association with second location information, storing and maintaining the second base station signal information in a second database, the second location information determined with respect to the divided grid by a predetermined second device location
30 determination method;
         searching the second location information corresponding to the base station signal information from the second database by comparing the base station signal

information and the second base station signal information; and

generating final location information based on the second location information and the location information.

5   15.   The method of claim 14, wherein the step of generating the final location information comprises one of the steps of averaging the location information and the second location information, and multiplying each of them by a weight.

16.   The method of claim 14, wherein the second device location determination
10   method is performed by using a GPS receiving apparatus.

17.   The method of claim 14, further comprising the steps of:

determining third location information by using a second device including the GPS receiving apparatus;

15   receiving third base station signal information with respect to the third location information by using the second device; and   -

updating the second base station information stored in the second database based on the third base station signal information.

20   18.   The method of claim 17, wherein the updated second base station information (a') is determined according to $a' = w * (1 - w) * b$ (a: second base station information, b: third base station information, and $0 < w < 1$).

19.   A location determination system for determining a location of a mobile
25   communication device in a mobile communication network including a plurality of base stations and repeaters, comprising:

a data collection unit receiving a plurality of pieces of base station information transmitted from the base station to the device;

a signal analysis unit determining one of the base station and the repeater
30   corresponding to each of the base station signal information based on the base station signal information;

a vector generating unit generating vector information associated with the

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plurality of the base stations and the repeaters based on geographic information corresponding to the one of the determined base station and the repeater; and

a location determination unit determining location information of the device according to the generated vector information,

5   wherein the vector generating unit determines a predetermined vector proceeding order associated with the plurality of the base stations according to the base station signal information and sequentially determining the vector with respect to the plurality of the base stations according to the determined vector proceeding order with one of the base station and the repeater with which the device is now communicating as

10   a starting point.

20.   The system of claim 19, further comprising:

a second database storing second base station signal information with respect to grids in association with second location information, an area covered by the mobile

15   communication network being divided into the grids, the second location information being determined by a predetermined second device location determination method; and

a second location determination unit searching the second location information corresponding to the base station signal information from the second database by comparing the base station signal information and the second base station signal

20   information and generating final location information based on the location information and the location information.

21.   The system of claim 20, further comprising:

a third location determination unit determining third location information by

25   using a second device including a GPS receiving apparatus;

a second data collection unit receiving third base station signal information with respect to the third location information by using the second device; and

a base station information update unit updating the second base station information stored in the second database based on the third base station signal

30   information.

22.   The system of claim 19, wherein the location determination system is installed

in the mobile communication device.

23.   A computer readable recording medium in which a program for executing the method according to any one of claims 1 to 13 and 15 to 18 is recorded.